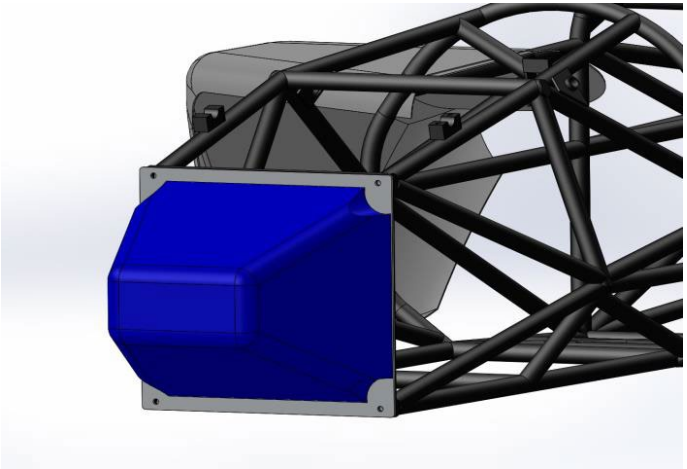
SES
(Structural-Equivalency-Spreadsheet)

F.8 Front Protection



Attenuator and Diagonal

IA has 4 choices. The test method should follow each type.

BLANK Attenuator and Diagonal

No Test: +

	BLANK			
F.8.4.1	Impact Attenuator Type:			BLANK
	Standard Foam Attenuator Height:	304mm (12in)		N/A
	Standard Foam Attenuator Width:	355mm (14in)		N/A
F.8.4.3	Front Bulkhead Outside to Outside Height:		mm	BLANK
	Front Bulkhead Outside To Outside Width:		mm	BLANK
	BLANK			
F.8.4.3	Diagonal Tube, Attenuator Test, or Composite			BLANK
		Minimum	Tube Used	EQ
F.3.2.1	Example: 25.4mm x 1.2mm round	Steel		BLANK
F.3.4.1	Diagonal Minimum Tube:	Size C		BLANK
	Wall thickness:	1.2		mm BLANK
F.3.4.1	Square side:	25		mm BLANK
	Wall thickness:	0.0012		m EQ
	Square side:	0.025		m EQ
	Tube cross sectional area (A):	9.10E-05		m^2 EQ
	Tube second moment of inertia (I):	6.70E-09		m^4 EQ
F.3.4.2	Young's Modulus (E):	2.00E+11	0.00E+00 Pa	BLANK
F.3.5	Sy:	3.05E+08	0.00E+00 Pa	BLANK
Critical Buckling Modulus Sy:	E_1*I_1 <= E_2*I_2:	1.34E+03		EQ
	S_1*A_1 <= S_2*A_2:	2.78E+04		EQ
Bending Deflection Energy	4*S_1*I_1/r <= 4*S_2*I_2/r:	6.43E+02		EQ
	Bending_1/(48*EI):	1.00E-02		EQ
	0.5*Bending^2/(48*EI):	3.22E+00		EQ

4 choices

Select each item.

Standard Foam

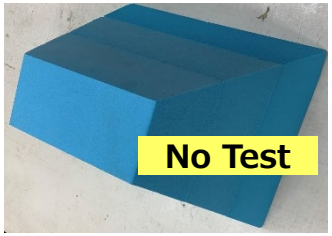
Standard Honeycomb

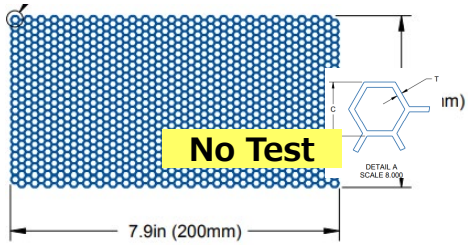
Custom-Non-Composite

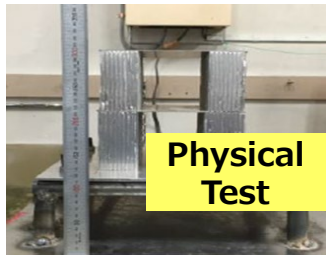
Custom-Composite : Meaning of monocoque structure

4 types of test methods depending on the IA type

No Test:	Standard Foam + Matched FB
No Test:	Standard Honeycomb +
Physical Test:	Custom IA + AIP + FB Replica
Dynamic Test:	Composite IA + AIP + FB Replica







Attenuator and Diagonal

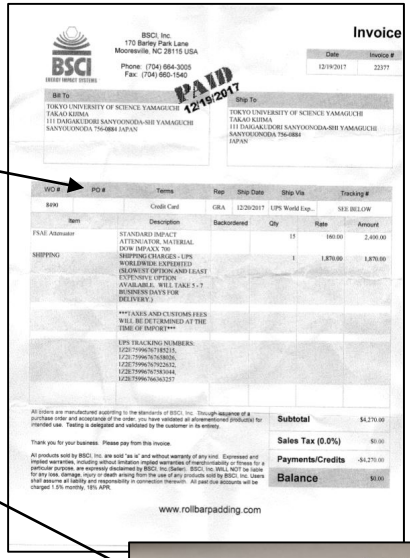
Attach requested evidence.

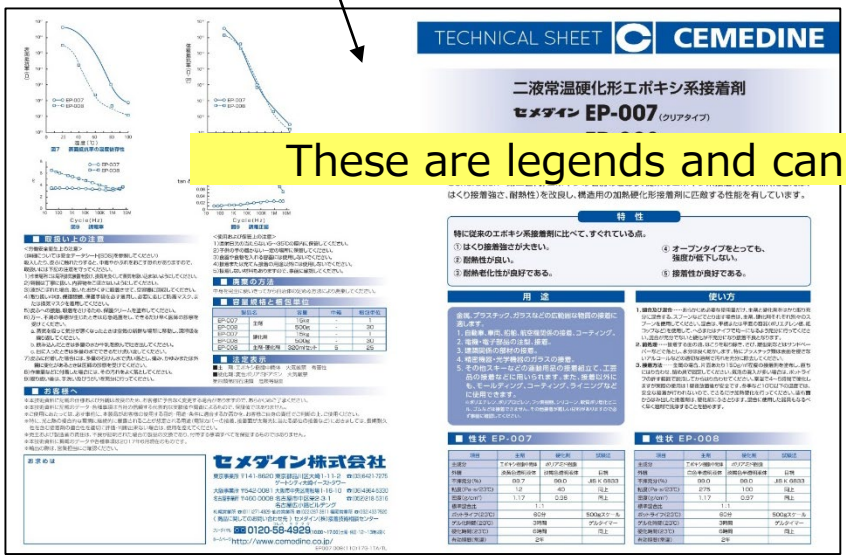
Insert Pictures - may be added left or below:

(a.) Standard Impact Attenuator Receipt

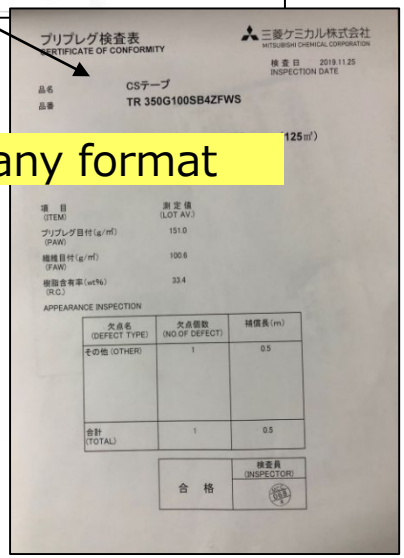
(b.) Adhesive Material Properties -
Indicate selected value, include units conversion

(c.) Composite Material Receipts
(if not already on 3-Point test tab)





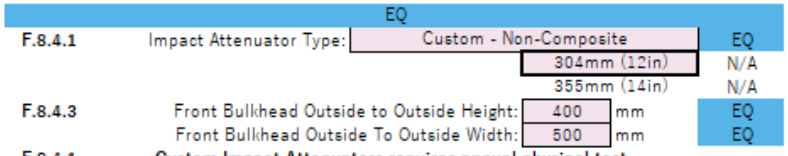
These are legends and can be in any format



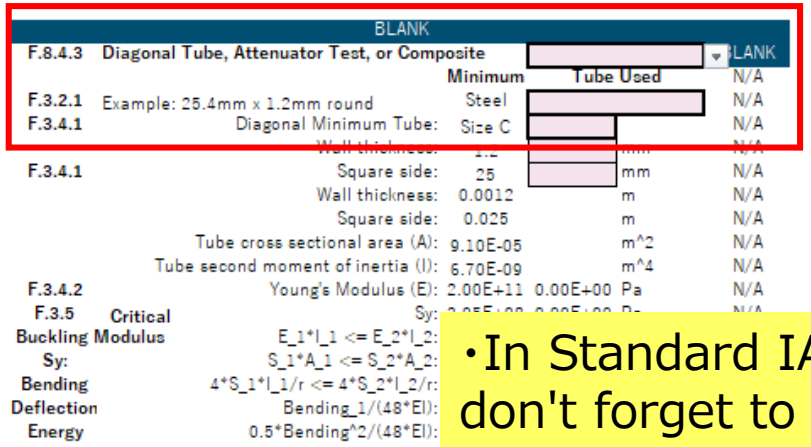
Attenuator and Diagonal

Added in 2023

Attach requested evidence.



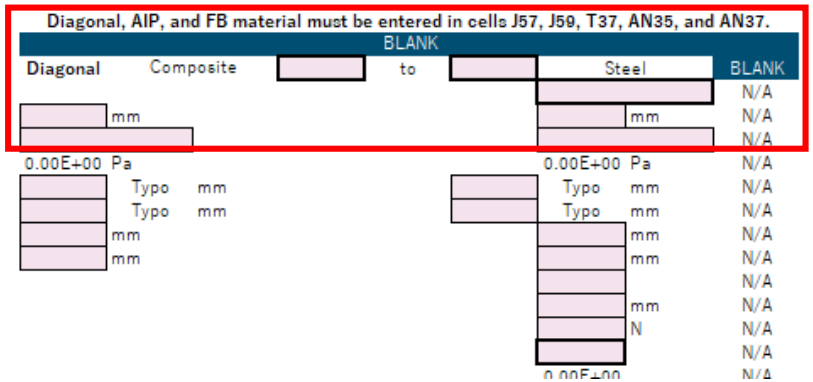
	EQ			
F.8.4.1	Impact Attenuator Type:	Custom - Non-Composite		EQ
		304mm (12in)		N/A
		355mm (14in)		N/A
F.8.4.3	Front Bulkhead Outside to Outside Height:	400	mm	EQ
	Front Bulkhead Outside To Outside Width:	500	mm	EQ
F.8.4.1	**Custom Impact Attenuators requires annual physical test.**			



	BLANK			
F.8.4.3	**Diagonal Tube, Attenuator Test, or Composite**			BLANK
		Minimum	**Tube Used**	N/A
F.3.2.1	Example: 25.4mm x 1.2mm round	Steel		N/A
F.3.4.1	Diagonal Minimum Tube:	Size C		N/A
	Wall thickness:	1.2	mm	N/A
F.3.4.1	Square side:	25	mm	N/A
	Wall thickness:	0.0012	m	N/A
	Square side:	0.025	m	N/A
	Tube cross sectional area (A):	9.10E-05	m^2	N/A
	Tube second moment of inertia (I):	6.70E-09	m^4	N/A
F.3.4.2	Young's Modulus (E):	2.00E+11	0.00E+00 Pa	N/A
F.3.5 Critical Buckling Modulus Sy: Bending Deflection Energy	Sy:			N/A
	E_1*I_1 <= E_2*I_2:			N/A
	S_1*A_1 <= S_2*A_2:			N/A
	4*S_1*I_1/r <= 4*S_2*I_2/r:			N/A
	Bending_1/(48*EI):			N/A
	0.5*Bending^2/(48*EI):			N/A

・In Standard IA, if you need Diagonal for FBH, don't forget to enter these as well.

F.8.4.3.a Tube frame teams should weld a diagonal to the Front Bulkhead.
F.8.4.3.a Monocoque teams should install diagonals with 2 * 30kN attachment to reduce testin
The structure must go across the entire front bulkhead opening on the diagonal.
If a front bulkhead or removable panel with no openings is not feasible, preferably a s
tube is welded or bonded to the AIP. Round tubes may not be welded or bonded to th



	Diagonal, AIP, and FB material must be entered in cells J57, J59, T37, AN35, and AN37.				
	BLANK				
Diagonal	Composite		to	Steel	BLANK
					N/A
	mm			mm	N/A
					N/A
0.00E+00	Pa			0.00E+00 Pa	N/A
	Typo mm			Typo mm	N/A
	Typo mm			Typo mm	N/A
	mm			mm	N/A
	mm			mm	N/A
					N/A
				mm	N/A
				N	N/A
					N/A
				0.00E+00	N/A

Added in 2023

Anti-Intrusion Plate

Physical test is required for Composite AIP.

Physical test required

No additional test for Steel or Aluminum AIP.

		BLANK		
F.8.2.1	Anti-Intrusion Plate (AI) material:	Steel		EQ
	Steel: 1.5mm (0.060in), Aluminum: 4.0mm (0.157in):		mm	BLANK

F.8.3.2 AI plates made of any material besides steel or aluminum must either:
F.8.3.2.a Be physically tested on a replica bulkhead up to 120kN,
with the load distributed over the 200 mm x 100mm minimum IA area.
F.8.3.2.b Show F.8.3.4 120kN equivalence from F.4.3.1 laminate testing.

		EQ			
F.8.3.2	**Composite Anti Intrusion:**	Steel			N/A
F.8.3.2	Composite AI Equivalence:				N/A
	Type SES Tab Name Of Layup Used:				N/A
	Core thickness:		mm		N/A
Scaling option, layup repeats:	Outer skin thickness:	Layup	mm		N/A
Scaling option, layup repeats:	Inner skin thickness:	Typo	mm		N/A
	Thickness of panel:	#VALUE!	mm		N/A
	Composite Panel Height:		mm		N/A
	Composite Panel Width:		mm		N/A
	Top Edge of FB to Top Edge of IA:		mm		N/A
F.8.3.1	Minimum Required Impact Attenuator Height:	100	mm		N/A
	Minimum Required Impact Attenuator Width:	200	mm		N/A
	Second moment of inertia I, Vertical:		m^4		N/A
	Second moment of inertia I, Horizontal:		m^4		N/A
	Young's Modulus (E):	Layup	Pa		N/A
	Ultimate Tensile Strength (S):	Name	Pa		N/A
	Shear:	Typo	Pa		N/A
F.8.3.1	Max Bending Moment, Vertical (120kN Partial UDL):		Nm		N/A
	Max Bending Moment, Horizontal (120kN Partial UDL):		Nm		N/A
	Max Bending * Max y / I = Max Stress, Vertical:		Pa		N/A
	Max Bending * Max y / I = Max Stress, Horizontal:		Pa		N/A
	UTS (S) / Max Stress = Safety Factor, Bending:				N/A
	Perimeter Shear Stress, 120kN Load:		Pa		N/A
	Safety Factor, Perimeter Shear:				N/A

Composite AIP -

		EQ		
F.8.2.1	Anti-Intrusion Plate (AI) material:	Composite		EQ
	Steel: 1.5mm (0.060in), Aluminum: 4.0mm (0.157in):		mm	N/A

F.8.3.2 - AIP 3-Point & Shear or 120kN Physical Test required.

F.8.3.2 AI plates made of any material besides steel or aluminum must either:
F.8.3.2.a Be physically tested on a replica bulkhead up to 120kN,
with the load distributed over the 200 mm x 100mm minimum IA area.
F.8.3.2.b Show F.8.3.4 120kN equivalence from F.4.3.1 laminate testing.

		BLANK			
F.8.3.2	**Composite Anti Intrusion:**	Composite			EQ
F.8.3.2	Composite AI Equivalence:				BLANK
	Type SES Tab Name Of Layup Used:				BLANK
	Core thickness:		mm		BLANK
Scaling option, layup repeats:	Outer skin thickness:	Layup	mm		EQ
Scaling option, layup repeats:	Inner skin thickness:	Typo	mm		EQ
	Thickness of panel:	#VALUE!	mm		EQ
	Composite Panel Height:		mm		BLANK
	Composite Panel Width:		mm		BLANK
	Top Edge of FB to Top Edge of IA:		mm		BLANK
F.8.3.1	Minimum Required Impact Attenuator Height:	100	mm		EQ
	Mi		mm		EQ
			m^4		EQ
			m^4		EQ
			Pa		BLANK
			Pa		BLANK
	Shear:	Typo	Pa		BLANK
F.8.3.1	Max Bending Moment, Vertical (120kN Partial UDL):		Nm		EQ
	Max Bending Moment, Horizontal (120kN Partial UDL):		Nm		EQ
	Max Bending * Max y / I = Max Stress, Vertical:		Pa		EQ
	Max Bending * Max y / I = Max Stress, Horizontal:		Pa		EQ
	UTS (S) / Max Stress = Safety Factor, Bending:				EQ
	Perimeter Shear Stress, 120kN Load:		Pa		EQ
	Safety Factor, Perimeter Shear:				EQ

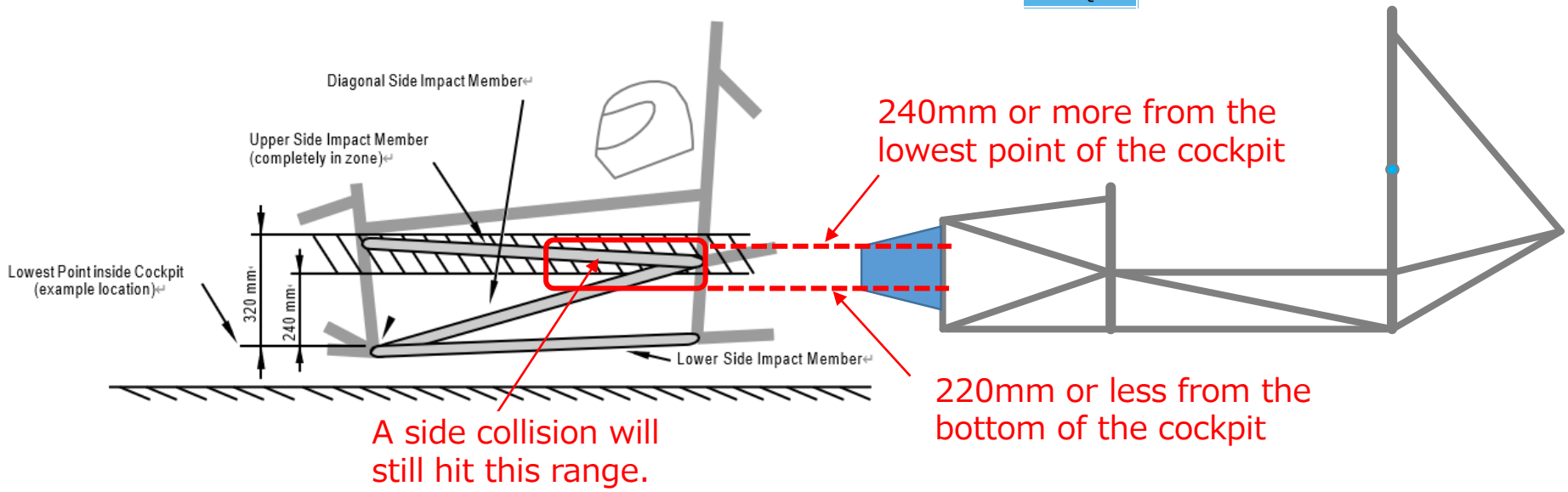
Items marked "BLANK" must be entered. It has to be "EQ".

IA Attachment

The items below are based on the concept that the tip of the IA hits the upper part of the SIS to protect the occupants in the event of a side collision from another vehicle.

That is, the Top part of IA must be this height.

BLANK			
Front top of IA > 240mm above lowest point in cockpit:		mm	BLANK
Front bottom of IA < 220mm above lowest point in cockpit:		mm	BLANK
F.8.5.2	IA to AI plate mounting method:		BLANK
			BLANK
		mm	BLANK
			BLANK
	0.00E+00	N	EQ
		N/mm^2	BLANK
	0	N/mm^2	EQ
		mm^2	BLANK
			EQ



Anti-Intrusion Plate, IA Attachment

Attach requested evidence.
Specific examples are not given because each team has its own way of thinking and calculation method.

Insert Pictures - continued:

(d.) Wing Detachment Material Properites

(e.) Other Wing Detachment Calculations
(if not using standard fastener shear)

Insert measurement of IA front top edge height.

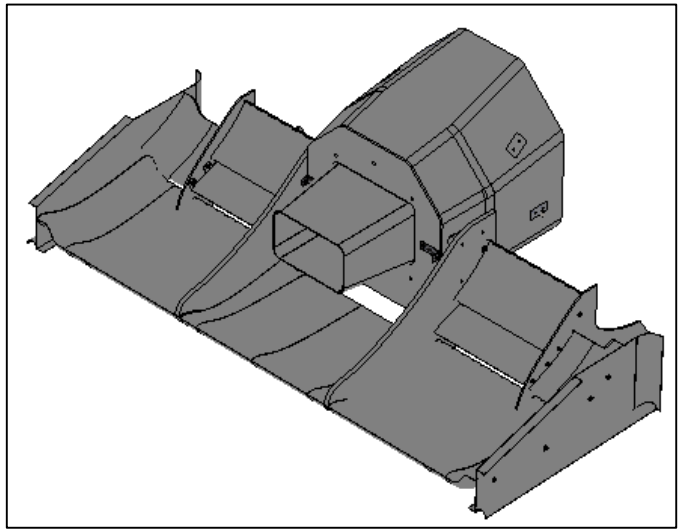
Shear Dimensions
Do not count holes as part of the area.
Even with precrush, honeycomb bond area is usually <50% of the face.

Insert measurement of IA front top edge height.

Shear Dimensions
Do not count holes as part of the area.
Even with precrush, honeycomb bond area is usually <50% of the face.

For the AIP and IA fixing methods, in addition to the isometric drawing below, enter and attach detailed information on brackets, stays, bolts, etc. in a three-sided drawing.

Every year, many of these deficiencies are the cause of reexamination.



The CAD drawing cited is from Tokai University.
The drawings are very clear and easy to review.
I won't go into details, but I'll show you with respect.

Wing Detachment

The concept of Front Wing is the same as before.

Note that there are 5 types of Front Wing Status and the input items are different.

	Front Wing Status:	No Front Wing		N/A
		No Front Wing		N/A
		Front Wing Physically Tested With IA		N/A
		Front Wing Physically Tested Without IA		EQ
		Standard Shear Calculation		EQ
		Custom Calculation		EQ
F.8.7.2.a	Peak deceleration force <= 120000N	95000	N	EQ
	Peak deceleration remains <= 40g:	32.3	g	EQ

If there is no Front Wing, no input other than item selection is required.

If you do a physical test with IA, select the following and do not need to enter.

		EQ		
	Front Wing Status:	No Front Wing		N/A
			N	N/A
				N/A
		0	N	EQ
	Peak Attenuator Force:	95000	N	EQ
F.8.7.2.a	Peak deceleration force <= 120000N	95000	N	EQ
	Peak deceleration remains <= 40g:	32.3	g	EQ

If you do a physical test without IA, select an item and enter the required item.

When calculating shear force with standard IA, select an item and enter the required item.

When calculating shear force with Custom IA, select an item and enter the required item.

		BLANK		
	Front Wing Status:	Front Wing Physically Tested Without IA		EQ
	Tested failure force:		N	BLANK
	Which column has the front wing force data?			BLANK
	Wing detachment force:	0	N	EQ
	Peak Attenuator Force:	95000	N	EQ
F.8.7.2.a	Peak deceleration force <= 120000N	95000	N	EQ
	Peak deceleration remains <= 40g:	32.3	g	EQ

BLANK Physical Tests

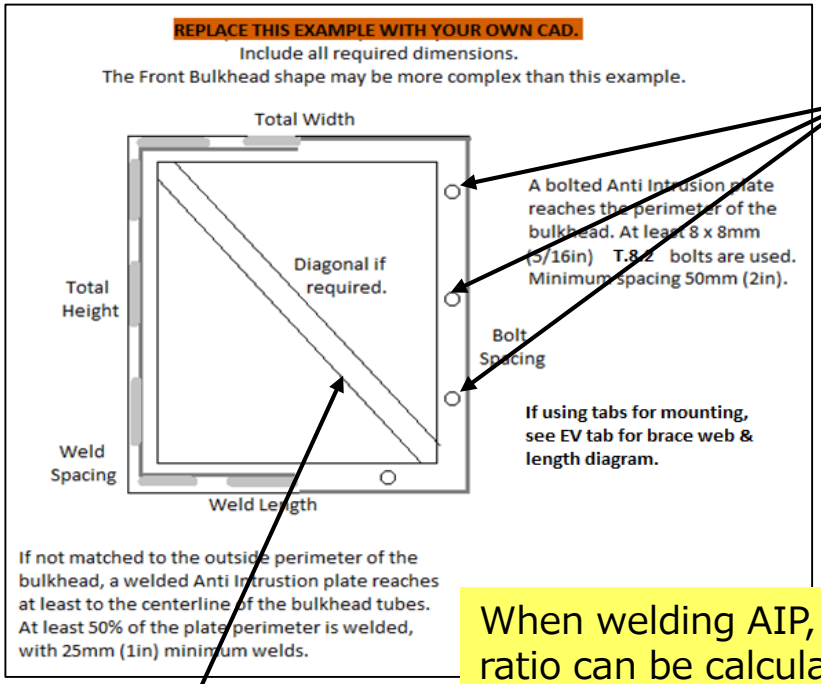
Insert Test Pictures - may be added below:
(a.) IA and FB test fixture before the test
(F.8.
spa
od of
igid
(b.)
(F.8.7.4
test
as less
(c.
ve
(d.) IA Energy Displacement Curve

If you do a physical test, attach photos before and after the test and photos showing the test method.

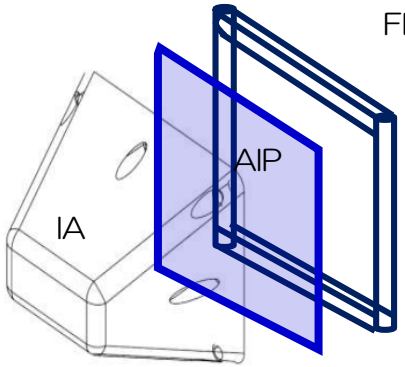
Paste in logged data from test below: It is acceptable to resample the data at a lower frequency to reduce the number of datapoints. Repeat the weighted average force and energy calculations in columns three and four. Do not assume all steps				Paste in logged data from test below: It is acceptable to resample the data at a lower		Paste in logged data from test below: It is acceptable to resample the data at a lower	
Disp. mm MAX 0	Force N MAX 0	Weighted N MAX 0	Energy J MAX 0	Disp. mm MAX 0	Force N MAX 0	Disp. mm MAX 0	Force N MAX 0

If you did a physical test, enter the raw data of the experimental results.
※ Compressed data every 1mm is recommended.

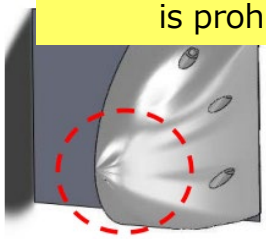
Front Bulkhead



For bolting by drilling directly into the FBH.
→ Put an insert. (regulation requirements)



Processing of standard IA is prohibited.



NOT PERMITTED: changed design or dimensions for Standard IA TYPE12

When welding AIP, the welding distance ratio can be calculated.

F.8.4.3 Diagonal required if standard IA (Form) with front bulkhead outside dimensions greater than 400 x 350 mm and if using standard IA (Honeycomb).

Front Bulkhead

Input items are different for Tube and Composite

For「Tube」

F.8.2.4	A 25mm gap is required between the AIP + FB + Diagonal and the pedal assembly.					
						BLANK
F.6.1	**Front Bulkhead**			Tube		EQ
			Minimum	**Tube Used**		EQ
F.3.2.1	Example: 25.4mm x 1.6mm round	Steel				BLANK
F.3.4.1	Front Bulkhead Minimum Tube:	Size B				BLANK
	Wall thickness:	1.2			mm	BLANK
F.3.4.1	Square side:	25			mm	BLANK
	Wall thickness:	0.0012			m	EQ
	Square side:	0.025			m	EQ
	Tube cross sectional area (A):	1.14E-04			m^2	EQ
	Tube second moment of inertia (I):	8.51E-09			m^4	EQ
F.3.4.2	Young's Modulus (E):	2.00E+11	0.00E+00		Pa	BLANK
F.3.5 Critical Buckling Modulus Sy:	Sy:	3.05E+08	0.00E+00		Pa	BLANK
	E_1*I_1 <= E_2*I_2:	1.70E+03				EQ
	S_1*A_1 <= S_2*A_2:	3.48E+04				EQ
Bending Deflection Energy	4*S_1*I_1/r <= 4*S_2*I_2/r:	8.17E+02				EQ
	Bending_1/(48*EI):	1.00E-02				EQ
	0.5*Bending^2/(48*EI):	4.09E+00				EQ

						EQ
F.7.3	Front Bulkhead Construction:	**Tube**	**Tube Diagonal**			N/A
	Front Bulkhead Tubes Replaced Size B:	**0**	Diagonal Size C:	**0**		N/A
	Type SES Tab Name Of Layup Used:					N/A
	Front Bulkhead					N/A
	Core thickness:				mm	N/A
Scaling option, layup repeats:	Outer skin thickness:	Layup			mm	N/A
Scaling option, layup repeats:	Inner skin thickness:	Typo			mm	N/A
	Thickness of panel:	#VALUE!			mm	N/A
	Front Bulkhead Height:				mm	N/A
	Front Bulkhead Width:				mm	N/A
	Cutout Height				mm	N/A
	Cutout Width				mm	N/A
	Composite Panel Height:	0			mm	N/A
F.3.4.2.a	Young's Modulus (E):	2.00E+11	Layup		Pa	N/A
	Ultimate Tensile Strength (S):	3.65E+08	Name		Pa	N/A
	Shear:	2.11E+08	Typo		Pa	N/A
F.7.3.2	**!5mm FBHS Section**					N/A
	Core thickness:	0			mm	N/A
	Outer skin thickness:	0			mm	N/A
	Inner skin thickness:	0			mm	N/A
	Thickness of panel:	0			mm	N/A
F.3.4.2.a	Young's Modulus (E):	2.00E+11	0.00E+00		Pa	N/A
	Ultimate Tensile Strength (S):	3.65E+08	0.00E+00		Pa	N/A
	Shear:	2.11E+08	0.00E+00		Pa	N/A
	0 x Steel Tube	**Flat (h)**				N/A
F.3.2.1	Minimum FB wall thickness:	0.0012	0		m	N/A
	Outer Diameter / Panel Thickness:	0.025	#VALUE!		m	N/A
F.3.4.1	Additive cross section (A):	0.00E+00	#VALUE!		m^2	N/A
	Additive second moment of inertia (I):	0.00E+00			m^4	N/A

For「Composite」

F.8.2.4	A 25mm gap is required between the AIP + FB + Diagonal and the pedal assembly.					
						EQ
F.6.1	**Front Bulkhead**			Composite		EQ
			Minimum	**Tube Used**		N/A
F.3.2.1	Example: 25.4mm x 1.6mm round	Steel				N/A
F.3.4.1	Front Bulkhead Minimum Tube:	Size B				N/A
	Wall thickness:	1.2			mm	N/A
F.3.4.1	Square side:	25			mm	N/A
	Wall thickness:	0.0012			m	N/A
	Square side:	0.025			m	N/A
	Tube cross sectional area (A):	1.14E-04			m^2	N/A
	Tube second moment of inertia (I):	8.51E-09			m^4	N/A
F.3.4.2	Young's Modulus (E):	2.00E+11	0.00E+00		Pa	N/A
F.3.5 Critical Buckling Modulus Sy:	Sy:	3.05E+08	0.00E+00		Pa	N/A
	E_1*I_1 <= E_2*I_2:	1.70E+03				N/A
	S_1*A_1 <= S_2*A_2:	3.48E+04				N/A
Bending Deflection Energy	4*S_1*I_1/r <= 4*S_2*I_2/r:	8.17E+02				N/A
	Bending_1/(48*EI):	1.00E-02				N/A
	0.5*Bending^2/(48*EI):	4.09E+00				N/A

						BLANK
F.7.3	Front Bulkhead Construction:	**Composite**	**Tube Diagonal**			EQ
	Front Bulkhead Tubes Replaced Size B:	**2**	Diagonal Size C:	**0**		EQ
	Type SES Tab Name Of Layup Used:					BLANK
	Front Bulkhead					EQ
	Core thickness:				mm	BLANK
Scaling option, layup repeats:	Outer skin thickness:	Layup			mm	EQ
Scaling option, layup repeats:	Inner skin thickness:	Typo			mm	EQ
	Thickness of panel:	#VALUE!			mm	EQ
	Front Bulkhead Height:				mm	BLANK
	Front Bulkhead Width:				mm	BLANK
	Cutout Height				mm	BLANK
	Cutout Width				mm	BLANK
	Composite Panel Height:	0			mm	EQ
F.3.4.2.a	Young's Modulus (E):	2.00E+11	Layup		Pa	BLANK
	Ultimate Tensile Strength (S):	3.65E+08	Name		Pa	BLANK
	Shear:	2.11E+08	Typo		Pa	BLANK
F.7.3.2	**!5mm FBHS Section**					EQ
	Core thickness:	0			mm	EQ
	Outer skin thickness:	0			mm	EQ
	Inner skin thickness:	0			mm	EQ
	Thickness of panel:	0			mm	EQ
F.3.4.2.a	Young's Modulus (E):	2.00E+11	0.00E+00		Pa	EQ
	Ultimate Tensile Strength (S):	3.65E+08	0.00E+00		Pa	EQ
	Shear:	2.11E+08	0.00E+00		Pa	EQ
	2 x Steel Tube	**Flat (h)**				EQ
F.3.2.1	Minimum FB wall thickness:	0.0016	0		m	EQ
	Outer Diameter / Panel Thickness:	0.025	#VALUE!		m	EQ
F.3.4.1	Additive cross section (A):	2.28E-04	#VALUE!		m^2	EQ
	Additive second moment of inertia (I):	1.70E-08			m^4	EQ

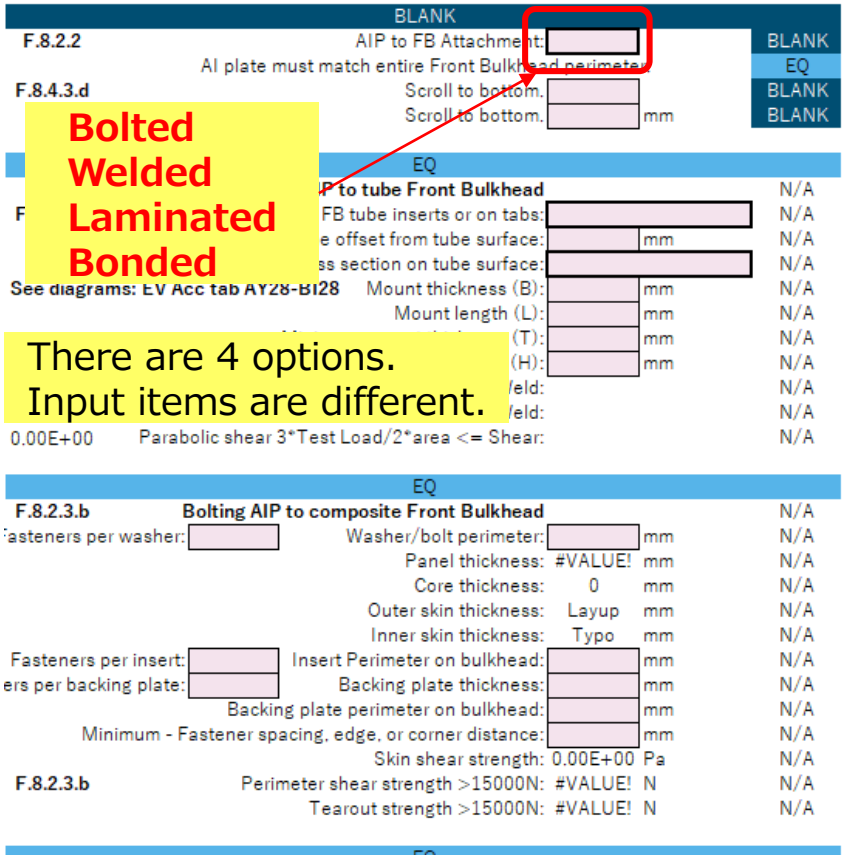
AIP Attachment

Attach requested evidence.

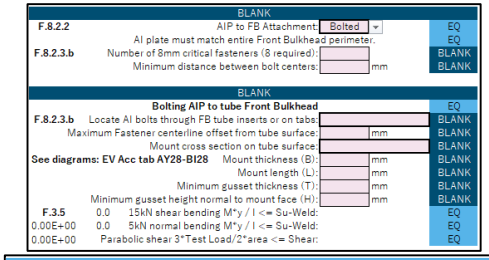
Bolted
Welded
Laminated
Bonded

There are 4 options.
Input items are different.

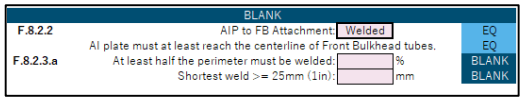
In 2023, Bonded was added.



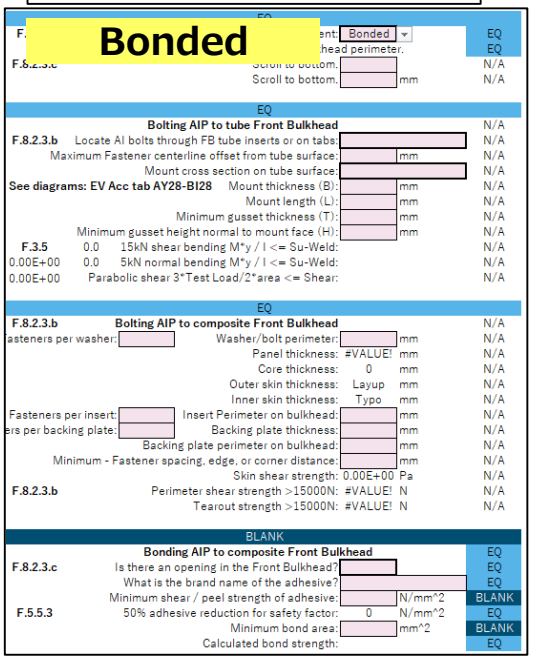
Bolted



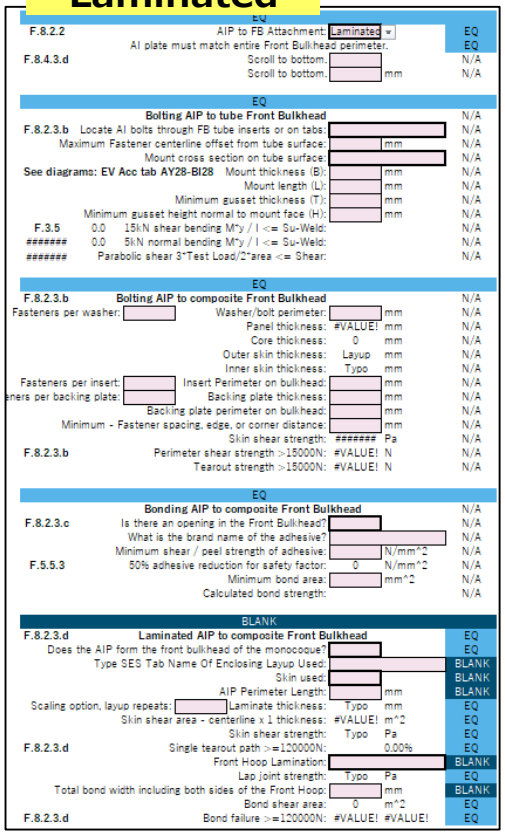
Welded



Bonded



Laminated

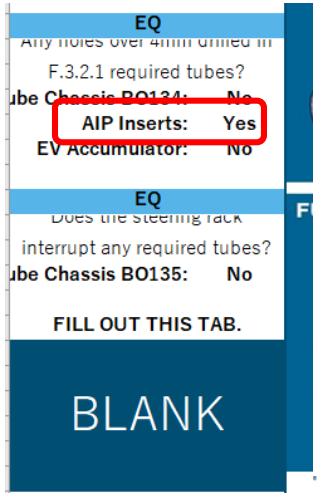


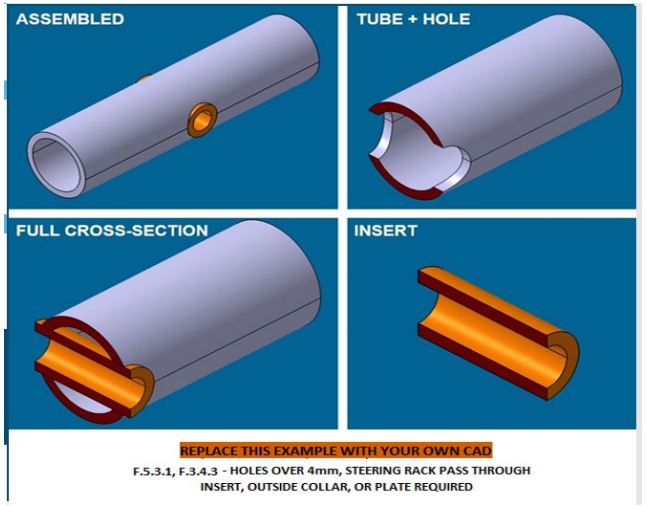
Caution：AIP Attachment

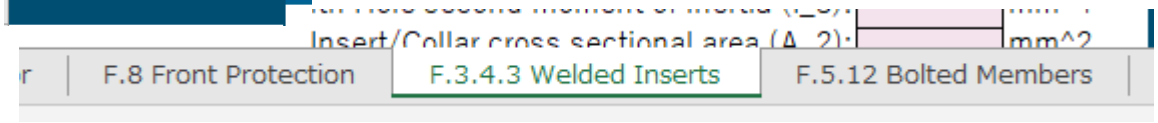
For Centerline Inserts, it is subject to "Welded Inserts".

EQ		
	Bolting AIP to tube Front Bulkhead	EQ
F.8.2.3.b	Locate AI bolts through FB tube inserts or on tabs: Centerline Inserts	EQ

Since AIP Inserts is judged as "YES" in the "F.3.4.3 Welded Inserts" sheet, enter it in this sheet.

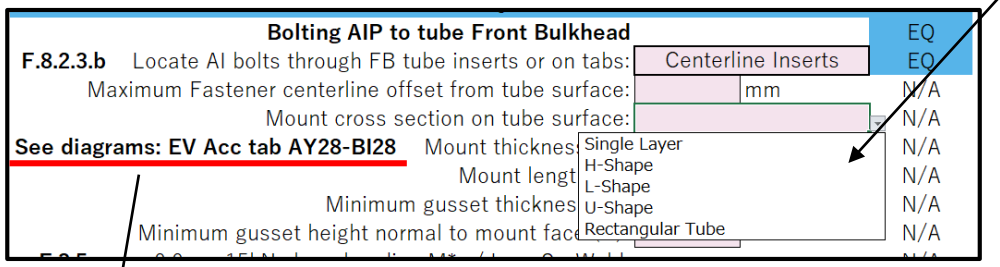




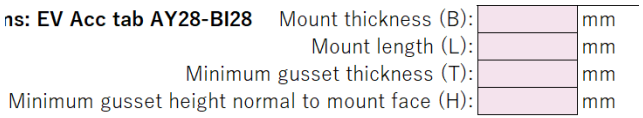


Caution：AIP Attachment

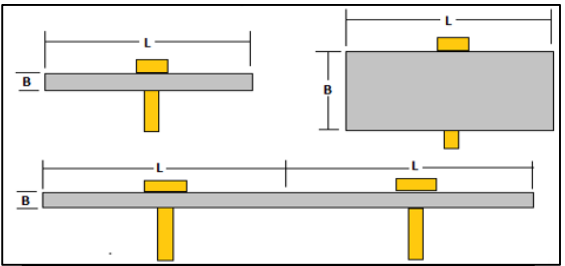
For “Offset Mount”



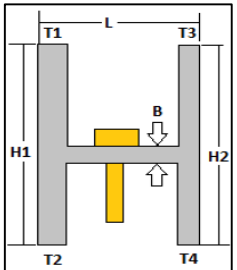
Select the tab shape and enter (B), (L), (T), and (H) according to the shape.



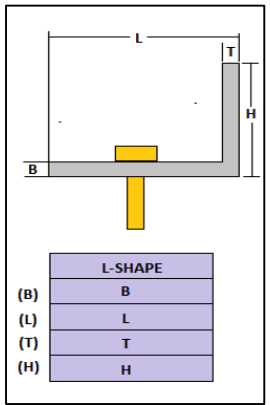
These pictures are interpreted as "the gray hatched surface is the welded surface".



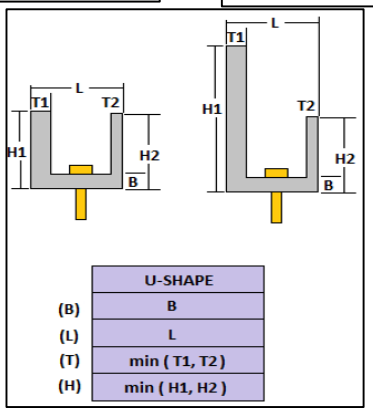
CROSS SECTION	SINGLE LAYER
MOUNT THICKNESS (B)	B
MOUNT LENGTH (L)	L
MINIMUM GUSSET THICKNESS (T)	L
MINIMUM GUSSET HEIGHT (H)	B



	H-SHAPE
(B)	B
(L)	L
(T)	min (T1, T2, T3, T4)
(H)	min (H1, H2)

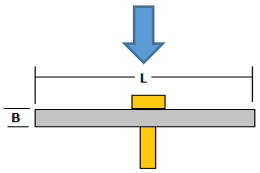


	L-SHAPE
(B)	B
(L)	L
(T)	T
(H)	H

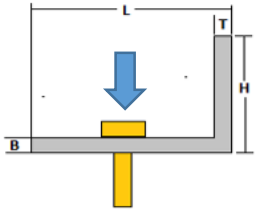


	U-SHAPE
(B)	B
(L)	L
(T)	min (T1, T2)
(H)	min (H1, H2)

Single Layer

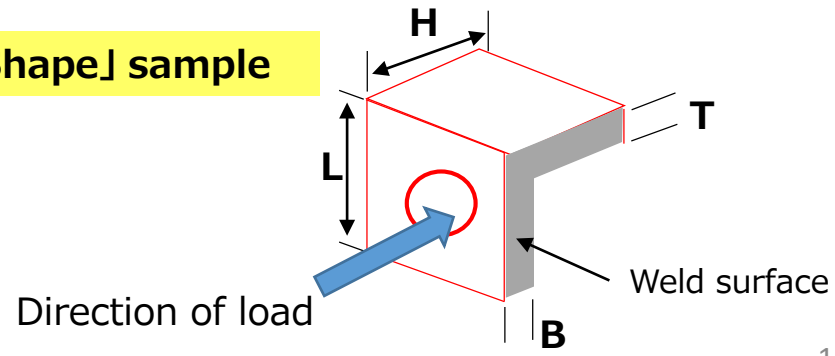


L-Shape



Consider how to attach the tab to the FBH, interpreting that the load in the direction of the arrow is applied to the gray welded surface.

「L-Shape」 sample



Physical Test Fixture Guidance

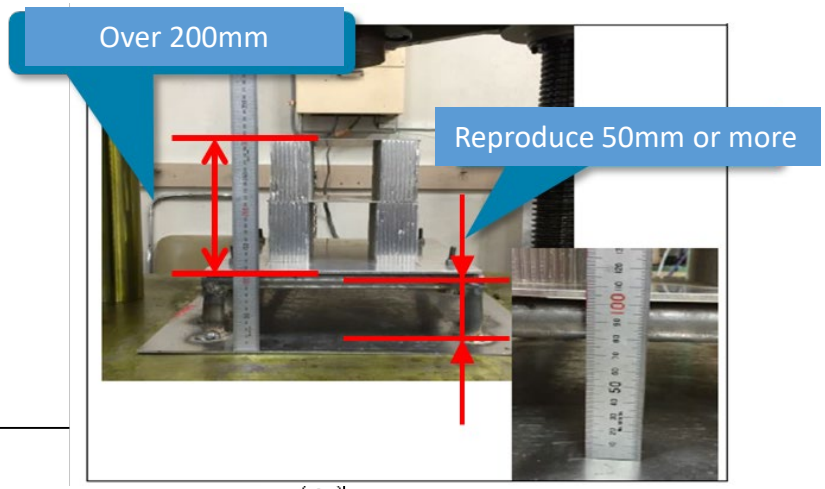
Attach requested evidence.

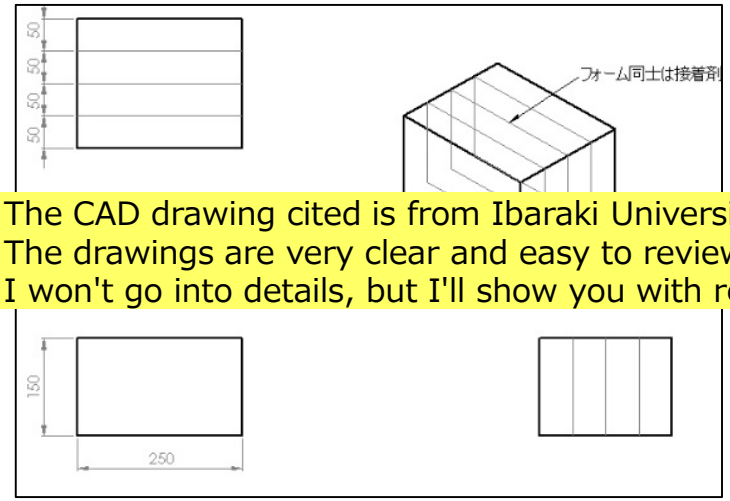
Enter a CAD drawing or photo showing the required dimensions in each blank.

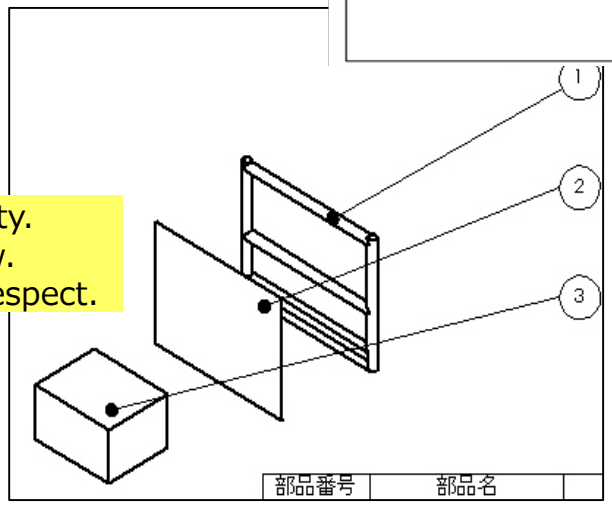
BLANK Physical Test Fixture Guidance

F.8.7.6.b The tested IA must be attached to a structurally representative section of the chassis.

	BLANK			
	Front Bulkhead Outside to Outside Height:	0	mm	BLANK
	Front Bulkhead Outside To Outside Width:	0	mm	BLANK
F.8.7.6.c	Fixture Thickness on table >=50mm:		mm	BLANK
F.8.4.2.a	Tested IA starting length > 200mm:		mm	BLANK
F.8.4.2b	Custom IA WIDTH over 200mm length >= 200mm:		mm	N/A
	Custom IA HEIGHT over 200mm length >= 100mm:		mm	N/A







The CAD drawing cited is from Ibaraki University.
The drawings are very clear and easy to review.
I won't go into details, but I'll show you with respect.

Physical Tests

Input items are different between semi-static and dynamic.
Fill in the blanks required for each. It has to be "EQ".

Impact Attenuator And / Or Wing Failure Test

	BLANK			
	Type of test used?:			BLANK
	Name of Test Facility:			BLANK
	Dates of tests:			BLANK
	Maximum crushed displacement:		mm	N/A
	Post crush displacement, demonstrating any springback:		mm	N/A
	Crushed attenuator height:		mm	N/A
F.8.7.6d	AI plate deformation:		mm	N/A

F.8.7.2b All calculated values must be based on a mass of 300kg and an initial velocity of 7m/s
F.8.7.7a Average deceleration from a dynamic test must be calculated from raw, unfiltered dat
F.8.7.7b Peaks above 40g must not be seen after the application of specific filtering. See rule.

F.8.7.2b The impact attenuator must absorb at least 7350J. Springback may be ignored.
Make sure to use stepwise integration: current_force*(current_disp-prev_disp)+previous_total
Do not assume steps are identical. Use similar procedure for average force.
INCORRECT: Final_force*final_displacement, or negative energy slope when there is positive fo

	BLANK			
F.8.7.2a	Peak attenuator force:		N	BLANK
	Peak attenuator only deceleration <= 40g:		g	BLANK
	Average attenuator force:		N	BLANK
	Average attenuator only deceleration <= 20g:		g	BLANK
F.8.7.2b	Energy absorbed >= 7350J:		J	BLANK
	Energy absorption check:	7350	J	EQ

EQ
EQ **EQ**
EQ
EQ

Composite AIP 120kN Physical Test

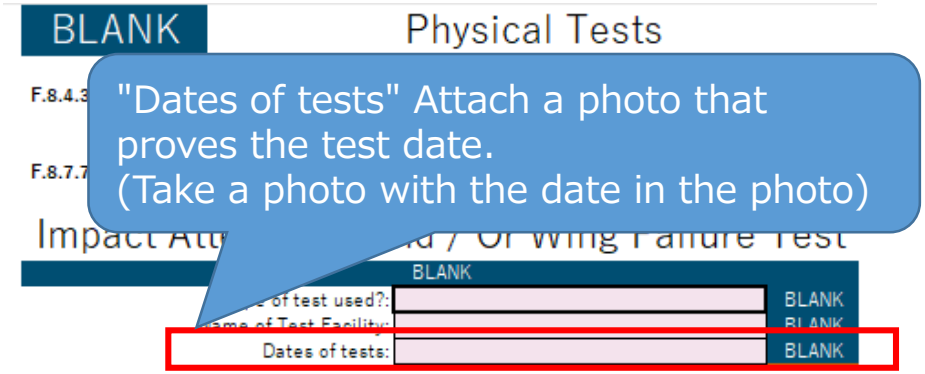
Teams may use a crushed attenuator of the version installed on the car to test a composite AIP.
Split the data following the IA test for the IA sections above and the 120kN test below.

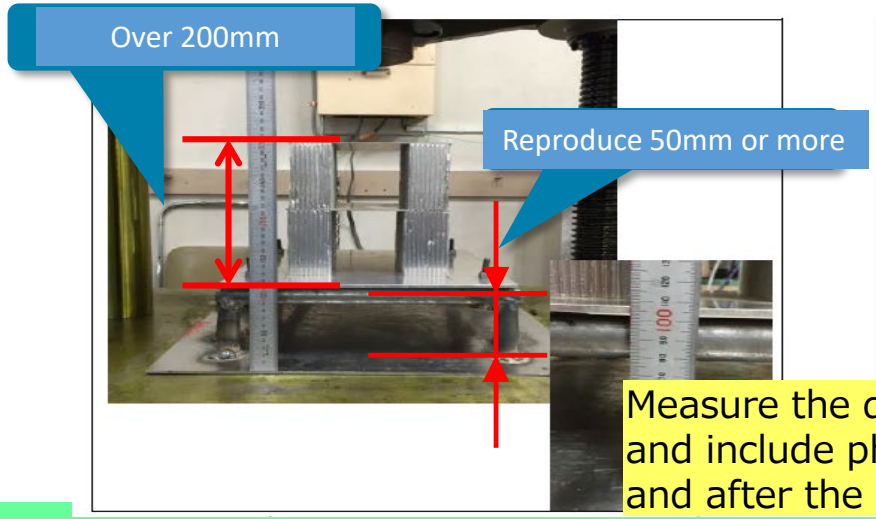
	EQ			
	Type of test used?:			N/A
	Name of Test Facility:			N/A
	Dates of tests:			N/A
	Maximum crushed displacement:		mm	N/A
	Post crush displacement, demonstrating any springback:		mm	N/A
F.8.7.6d	AI plate deformation:		mm	N/A
F.8.3.1.b	Maximum AIP force > 120kN:		N	N/A

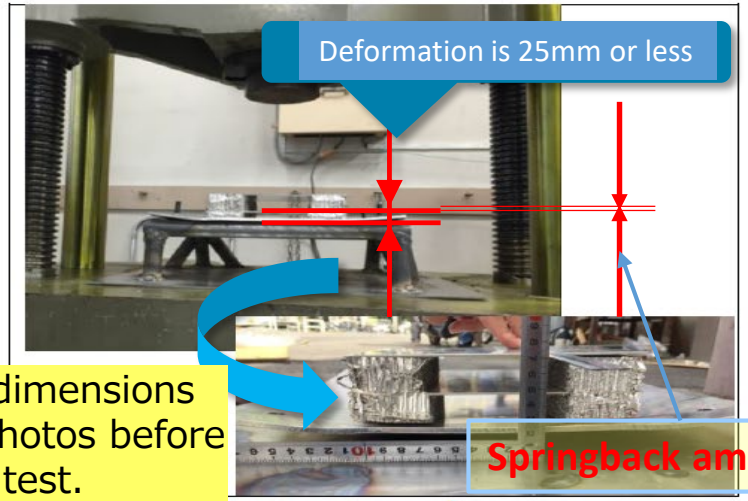
Physical Tests

Attach requested evidence.

Insert Test Pictures - may be added below:
(a.) IA and FB test fixture before the test (F.8.7.4.d) which also shows the method of spacing AIP at least 50mm from any rigid structure (F.8.7.6.c)
(b.) IA, Anti-Intrusion Plate after the IA test (F.8.7.4.d) which shows the deflection was less than 25.4mm (F.8.7.6.d)
(c.) IA / AIP Force Displacement Curve
(d.) IA Energy Displacement Curve





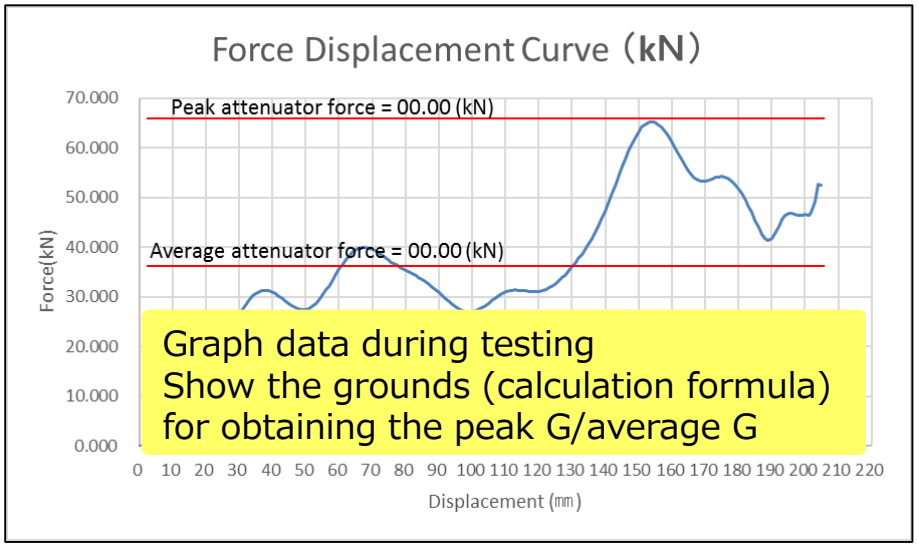


Measure the dimensions and include photos before and after the test.

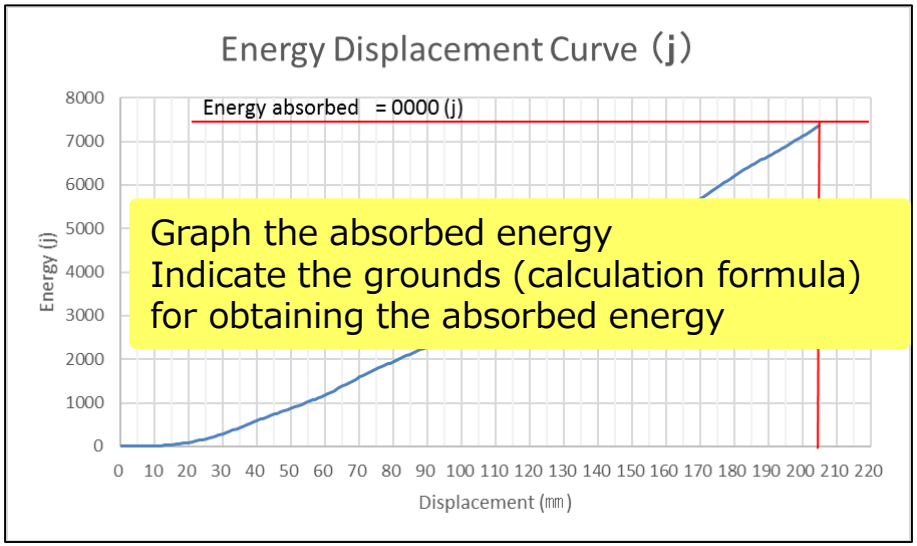
①Photo before impact attenuator test
②Reproduce 50mm or more from the penetration prevention plate, and put the impact attenuator on it.
* We recommend placing a plate on the tip of the foot and welding!

(1) Photograph after impact attenuator test
(2) Measure the amount of deformation of the penetration prevention plate
(3) Measure the amount of IA springback

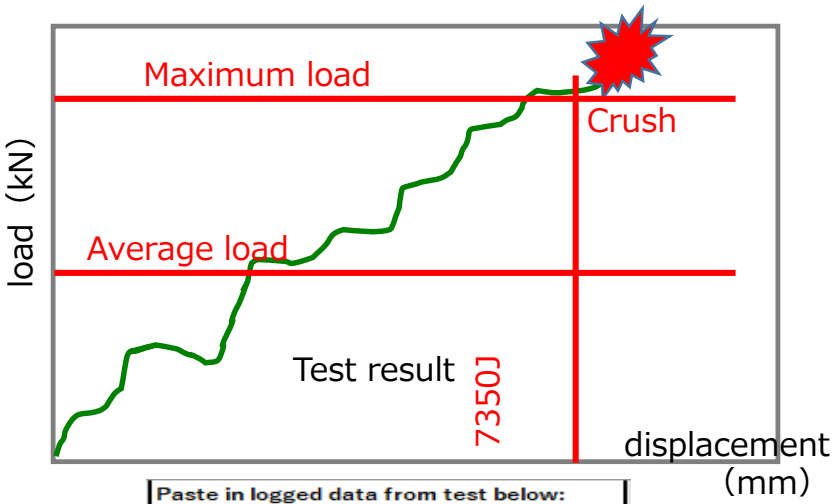
Physical Tests



Graph data during testing
Show the grounds (calculation formula) for obtaining the peak G/average G



Graph the absorbed energy
Indicate the grounds (calculation formula) for obtaining the absorbed energy



Paste in logged data from test below:
It is acceptable to resample the data at a lower frequency to reduce the number of datapoints. Repeat the weighted average force and energy calculations in columns three and four. Do not assume all steps are

Disp. mm MAX 15	Force N MAX 6511	Weighted Average Force N	Energy J MAX 12.386
0	0		0
1	4		0.004
2	35		0.039
11	3694		6.507
12	4186		7.88
13	4713		8.899

It is recommended to fill in every 1 mm.
It is recommended to show the calculation formula that shows how the average load and absorbed energy were obtained.

Shows data up to maximum displacement

supplement

Continuously compress the attenuator with a compression tester and find the reaction force (KN) against the stroke (mm) at that time.

The final energy is obtained by accumulating the energy required for minute deformation (measured force * deformation amount of unit length), and finally reaching 7350j or more determined by the rule.

The energy for the amount of deformation accumulates the numerical value = integrates > 0 to deformation (until complete collapse) accumulates the energy.

Energy = F [N]＊S [m] = F [kN] ＊1000 ＊ S [mm]/1000

Deceleration = F [N] /300kg＊ 9.8ms= F [N] /2940=○G

Create materials for IAD by referring to the following sample.

Impact Attenuator Energy calculation sample sheet

measuring data1

measuring data2

Attach raw data.

Energy=F*Displacemen

unit [N*m]

Displacement [mm]	Force [kN]	Energy [J = kN*1000*mm/000]
0	0	0
1	10	10
2	20	30
3	30	60
4	31	91
5	29.4	120.4
6	33	153.4
7	35	188.4
8	36	224.4
9	38	262.4